

**REPORT SUMMARY**  
**WOOD RIVER LEVEE SYSTEM, MADISON COUNTY, ILLINOIS**  
**RECONSTRUCTION PROJECT**

**STUDY INFORMATION**

**Study Authority.** This study is authorized by the Resolution of the Committee on Transportation and Infrastructure, U.S. House of Representatives, dated May 7, 1997, which reads:

*“Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army is requested to review the report of the Chief of Engineers on the Mississippi River between Coon Rapids Dam, Minnesota, and the mouth of the Ohio River, published as House Document 669, 76<sup>th</sup> Congress, 3<sup>rd</sup> Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at this time, for the purpose of reconstructing the facilities of the Wood River Drainage and Levee District along the Mississippi River in Madison County, Illinois to return the levee and pump stations and other appurtenant features to their original degree of protection.”*

**Study Sponsor.** Wood River Drainage and Levee District.

**Study Purpose and Scope.** The purpose of this draft Limited Re-evaluation Report is to investigate the existing condition of the Wood River Levee system in order to determine what if any actions are required to return the levee, pump stations and other appurtenant features to a condition that ensures they continue to provide their intended original degree of protection into the future. The report is a final response to the study authority.

**Project Location/Congressional District.** Wood River Drainage and Levee District (Levee District) lies in southwestern Illinois, on the left bank of the Mississippi River flood plain, within Madison County, Illinois, between river miles 195 and 203 above the Ohio River. (Figure 1). The levee district is protected by an urban design levee, across the Mississippi River from St. Louis and St. Charles counties in Missouri. The study area lies in the Mississippi River flood plain of Madison County, Illinois, just upstream of the city of East St. Louis. The study area is located in Congressional Districts:IL-12, Jerry F. Costello, and IL-19, John Shimkus.

**Prior Reports and Existing Water Projects.**

**Reports and Studies**

(1) Grassy Lake Pump Station. The Flood Control Act, approved 27 October 1965 by Public Law 89-298, House Document No. 150, 88<sup>th</sup> Congress, First Session, modified the

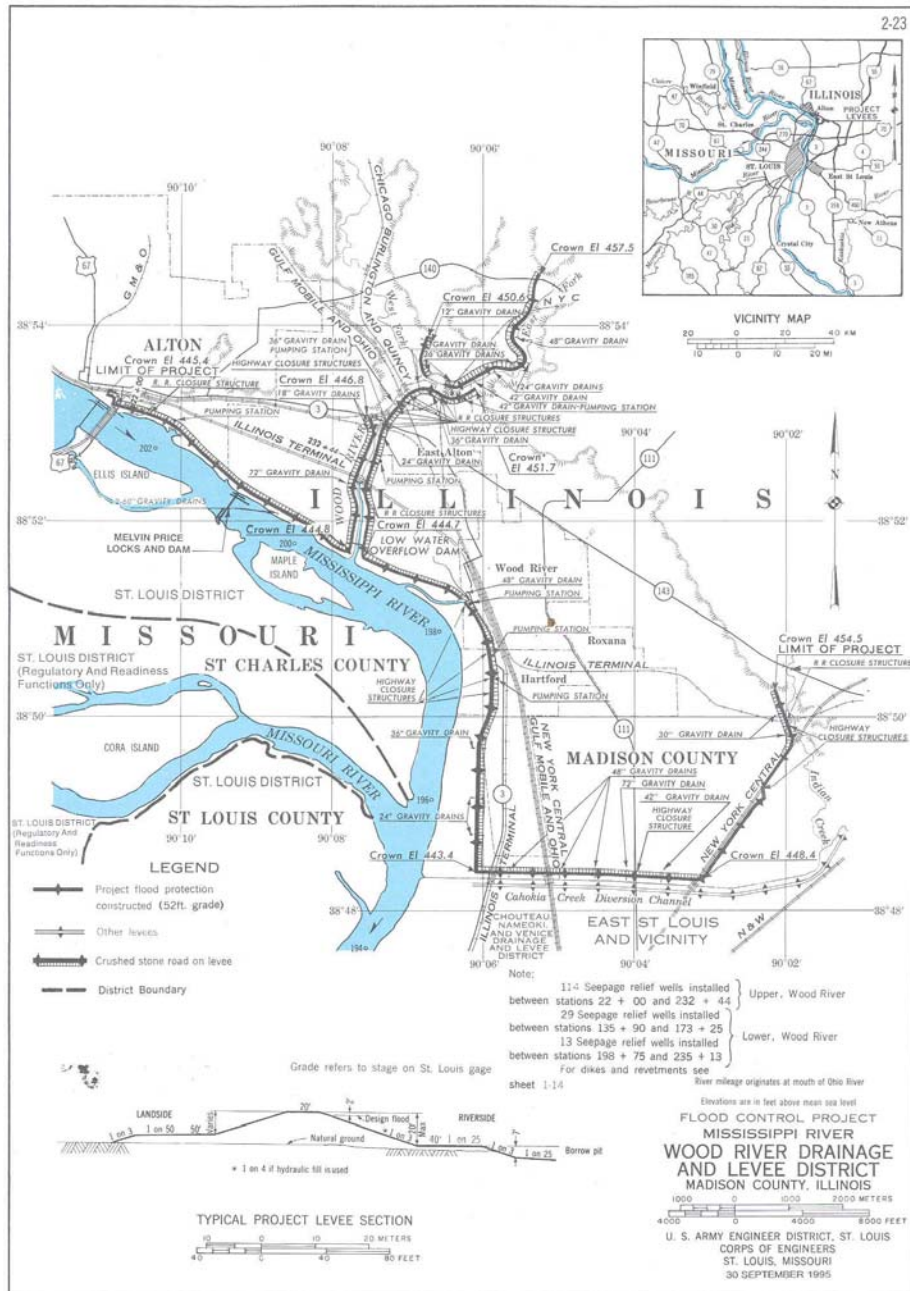


Figure 1. Wood River Drainage and Levee District, Site Location Map

project to provide for construction of a pumping station with collector ditches and necessary appurtenant facilities for removal of interior water impounded by the existing levee. This project was never constructed and a Reconnaissance study for the Wood River Drainage & Levee District, Illinois - Pump Station, dated January 1998, was approved for Pre-Engineering Design. The purpose of this project is to solve interior

flooding near the southern end of District through the addition of a 45-cfs pump station as a new feature to the original system. This station has not yet been constructed.

(2) Design Memorandum No. 16 Wood River Drainage and Levee District Alteration, March 1985. DM documents changes required to the Upper Wood River Levee System resulting from the Lock and Dam No. 26 (Replacement), Mississippi River.

(3) 1993 P.L. 84-99 Memorandum. Memorandum, CELMV-CO-E, dated 9 March 1994, Subject: Project Approval/Funding Request, Final Repairs, Wood River Drainage and Levee District, Madison County, Illinois, provided assessment of system performance failures recommended for emergency repairs, under authority of PL84-99/PL99-662, resulting from the flood of 1993.

(4) Periodic Inspection No. 7. Periodic Inspection No. 7, Levee and Closure Structures, Wood River Flood Protection Project, dated March 1997, which documents system performance deficiencies identified as a result of problems experienced during the 1993 flood.

(5) Reconnaissance 905(b) Report. Wood River Levee, Illinois, Flood Damage Reduction 905b Report dated April 1999. This report was prepared in response to study authorization 4.1 above, and details problems identified during and after the flood of 1993 and recommends project reconstruction be further investigated.

### **Existing Water Projects**

(1) Wood River Levee Project. The Wood River Levee project originally was authorized by the Flood Control Act of 28 June 1938, Flood Control Committee Document No. 1, 75<sup>th</sup> Congress, and First Session to provide flood protection to urban, agricultural and industrial areas.

(2) Mel Price Lock and Dam. The Internal Revenue Code of 1954 - Bingo - Tax - Exempt Organizations, Public Law 95-502 (H.R. 85331), October 21, 1978. Title I - Replacement of Locks and Dam 26; Upper Mississippi River System Comprehensive Master Management Plan. This project resulted in pool modifications that authorized the addition of a pump station for the Wood River Levee System.

**Federal Interest.** Based on a positive benefit-cost ratio and no significant environmental impacts, it has been determined that the reconstruction project for the Wood River Levee System is in the interest of the Federal government. At current estimates, levee failure could cost some \$1.5 billion dollars in economic damages, and potentially another \$2 billion dollars in environmental damages.

### **STUDY OBJECTIVES**

**Problems and Opportunities.** The potential for levee failure is a major problem. As time continues to pass without a comprehensive reconstruction being undertaken for the

Wood River Drainage and Levee System the probability that the project will fail continues to increase. The Wood River Drainage and Levee District has remained a good steward of this Federal infrastructure. They have historically and continue to provide routine operation and maintenance of the system and take action to repair as circumstances require in accordance with the agreements under which they assumed Sponsorship responsibility. However, as all parts of this integral system continue to degrade with time the chances of multiple failures occurring simultaneously continue to increase. The opportunity exists to proactively take action to reconstruct the system now in order to prevent a future catastrophe caused by system deterioration.

**Planning Objectives and Constraints.** The objective of this study is to prevent flood damages and flood related costs by restoring operational functionality of the levee system and appurtenances to ensure the system continues to provide its intended level of protection.

## **ALTERNATIVES**

**Plan Formulation Rationale.** Three basic alternative plans were used to guide the alternative development process for this study. The No Action alternative assumed no action would be taken. Under this scenario the Levee District would continue to perform its operation and maintenance responsibilities and maintain their standing in the P.L. 84-99 program, but no Federal action outside of the P.L. 84-99 program would be taken. The reconstruction alternative sought to identify actions that could be taken to correct system deficiencies through a variety of specific approaches that would be equal in performance to replacement. The replacement alternative sought to identify actions that could be taken to correct system deficiencies through replacement of system components. (Table 1)

**Comparison of Alternatives.** For each of these three basic alternative plans, costs were calculated so that they could be evaluated against one another. In each instance the final recommended action was determined to be necessary in order to provide the original level of protection. In this manner each of the system features were analyzed and evaluated.

**Key Assumptions.** Development is expected to continue on the interior, as a major Interstate Highway has recently opened in the Levee District. The connection that this new highway makes to the regional interstate system increases the likelihood of future development in the project area. The surrounding region has become a distribution center and this new interstate spur, which will soon be further expanded, makes the project area attractive for development. New investments by Conoco-Phillips and the issuance of another permit for refinery operations during the spring of 2004 by the State would

**Table 1**  
**Management Measures and Alternative Plans / Final Array of Alternatives.**

<b>ALTERNATIVES</b>		
<b>Component</b>	<b>Refurbish</b>	<b>Replace</b>
<b>Gravity Drains</b>	Insituform or slip lining.	Use reinforced concrete pipe.
Sluice Gates & Flap Gates	Remove and refurbish sluice and flap gates.	Replace sluice and flap gates.
Gatewell Structures	Sand black and recoat steel handrails and existing steel bridge joists. Reconstruction of the steel grating was determined to be cost prohibitive.	Replace steel grating and handrails with fiberglass.
<b>Closure Structures</b>		
Concrete Structures	Removal and replacement of joint sealant material patch; chemical injection grouting, epoxy grouting or concrete encapsulation of the damaged concrete.	Remove and replace monoliths, sill concrete, corner protections and gate seals.
Gates/Stoplogs	Sand blast and paint, replace seals and add steel skinplate.	Fabricate and install new steel gates.
<b>Pump Stations</b>		
Gravity Drains	Line concrete pipes, repair box culvert.	Replacement was infeasible.
Pump Station Structures	Replacement of trashracks, misc. metal, and roofing and tuckpointing.	Replacement of pump station structures was not warranted.
Pumps and Motors	Removal, disassembly, and replacement or refurbishment of pump and motor components.	Existing pumps at various locations could be replaced.
Sluice Gates & Flap Gates	Removal, disassembly, and replacement or refurbishment of gate and gate hoist assemblies and components.	Replace sluice gates and hoists, and gate flaps.
Electrical Equipment	Repair parts are no longer available; this option was not pursued.	Replace existing electrical equipment.
<b>Underseepage</b>		
Existing Relief Wells	Replace or refurbish based on pump test of wells	Replace all existing wood-stave wells with stainless steel wells
Underseepage Control	Install new relief wells, seepage berms, slurry walls	

indicate that this base will continue to expand also. This increases the importance of the flood protection system to perform as intended in the future. However, as the levee systems' features continue to degrade as a result of flood events and to exceed their performance life, the systems' ability to operate, as originally intended under future flood events becomes an even greater concern. If no action is taken underseepage problems and degradation of gravity drain structures pose a threat to the integrity of the levee while further degradation to pumping stations and appurtenant works could cause interior flooding that can impact industries, infrastructure and interrupt the transportation system. Future odds increase that a significant failure could occur under the no action alternative.

### **Recommended Plan.**

#### Design Deficiency Correction

According to Engineer Regulation ER 1165-2-119, a design or construction deficiency is a flaw in the Federal design or construction of a project that significantly interferes with the project's authorized purposes or full usefulness as intended by Congress at the time of original project development. Corrective action, therefore, falls within the purview of the original project authorization. Work to correct a design or construction deficiency may be recommended for accomplishment under existing project authority without further Congressional authorization if the proposed corrective action meets all the following conditions:

- It is required to make the project function as initially intended by the designer in a safe, viable and reliable manner; e.g., pass the original design flow without failure. This does not mean the project must meet present-day design standards. However, if current engineering analysis or actual physical distress indicates the project will fail, corrections may be considered a design or construction deficiency if the other criteria are met.
- It is not required because of changed conditions.
- It is generally limited to the existing project features. Remedial measures that require land acquisitions or new project features must not change the scope or function of the authorized project.
- It is justified by safety or economic considerations.
- It is not required because of inadequate local maintenance.

*Additional Relief Wells.* The analysis of underseepage requirements for the Wood River flood protection system indicates that a total of 60 new wells are required to meet original design intent. Additional borings and comprehensive underseepage analysis will be conducted prior to installing any additional relief wells in the East and West Fork levee reaches.

*Existing Relief Wells.* The recommended plan for restoring effectiveness of the relief well system is replacement of all existing creosote impregnated wood stave wells with new stainless steel wells. The 50-year plus age of the majority of the existing wells, the fragile nature of their wood screens, the lack of an effective monitoring and maintenance

program throughout their operational life, and the environmental constraints and ensuing costs of working on the creosote treated wood stave wells makes the successful rehabilitation of these wells unpredictable and not economically justified.

The estimated construction cost for the design deficiency correction work (replacement and new relief wells) is \$7,359,000.

### Reconstruction

The following items fall into the category of reconstruction. These items would be cost shared with the non-Federal sponsor on a 65% Federal and 35% non-Federal basis but could be undertaken only through additional authority required to undertake this work.

*Gravity Drainage Structures.* Of the thirty-eight corrugated metal pipe gravity drains, 25 will be lined with high density polyethylene pipe and 13 will be replaced with the same size reinforced concrete pipe at a cost of \$4,803,200.

*Closure Structures.* Removal and replacement is recommended for four sills and one approach apron. Three closure structures are recommended to be permanently closed. Eleven gates will be reconstructed, five gates will be replaced, three gates will be removed as the closure will be permanently closed and two gates will require no action. No action is required at the five stoplog closures. Investigation of three closure structure monoliths, three closure structure monoliths and floodwalls and one gateway structure indicates that while they have been in place for many years, in comparison to other like structures in the system, they are deficient. In each situation deterioration is directly attributable to the poor quality of the concrete aggregate with the possibility of low or no entrained air. The aggregate used in the concrete is soft and appears to be highly absorptive. Since there is no legal recourse against any contractors for any alleged construction deficiencies it is recommended that these items be addressed by the reconstruction project. The cost for reconstruction/replacement of these items is \$3,152,100.

*Pump Stations.* East Alton No. 2, Wood River, Rand Avenue and Hawthorne Street Pump Station structures will be reconstructed to include trashracks, grating, roofing, ladders, discharge chamber embedded metals, chain link fences and tuckpointing. Lakeside and Homegarden Pump Station structures will have grating and sheet metal roofs replaced. At East Alton No. 2 both stormwater pumps and their associated electric motors will be completely reconstructed and each of the three sluice gates gate slides and frames reconstructed with gate stem and stem guides replaced. At Wood River Pump Station the vertical stormwater pumps and their associated electric motors will be reconstructed, the baseflow pump replaced with a submersible centrifugal pump, and of the eleven sluice gates, seven gate slides and frames are to be reconstructed with gate stem and stem guides replaced with four of these gates having manual operated gate hoists replaced with electric and three being reconstructed but remaining manually operated. At Rand Avenue Pump Station the one remaining original electric motor will be completely reconstructed and each of the six sluice gates gate slides and frames will

be reconstructed with gate stem and stem guides replaced with two gates having manually operated gate hoists replaced with electric and four being reconstructed but remaining manually operated. At Hawthorne Street Pump Station both stormwater pumps and their associated electric motors will be completely reconstructed and the two sluice gates gate slides and frames will be reconstructed with gate stem and stem guides replaced with one of these gates having a manual operated gate hoist replaced with electric and one being reconstructed but remaining manually operated. At Lakeside Pump Station the existing vertical pump will be replaced with a pump of similar design and the vertical electric motor completely reconstructed. At Homegarden Pump Station the existing vertical pump will be replaced with a pump of similar design and the vertical electric motor completely reconstructed. At the East Alton No.1 Pump Station the trash rack will be replaced. The cost for reconstruction/replacement of these items is \$4,341,000.

**Systems / Watershed Context.** The loss of the Wood River Levee system would not only have devastating economic impacts in the traditional measurement of losses but would have the added implication of creating an environmental contamination scenario not experienced on any inland waterway system to date. Not only would the land-side of the levee experience significant contamination from oil, oil byproducts and chemicals used in the refining process, but the Mississippi River system itself would be impacted. At a conservative estimate of \$125,000 per acre of clean up costs a loss of this levee would result in environmental damages exceeding \$2,000,000,000 (two billion dollars) not including the relocation costs of residents and future loss of agriculturally productive land.

**Environmental Operating Principles.** As this project involves reconstruction of an existing project, impacts to the environment are minimal. In fact, it has been determined that the project poses no significant impacts. The project does support environmental responsibility as the project protects a significant industrial area with the potential of \$2,000,000 in environmental damages should the Wood River Levee system fail. Not only would the land-side of the levee experience significant contamination from oil, oil byproducts, and chemicals used in the refining process, but the Mississippi River system itself would be impacted. In addition, by replacing rather than rehabilitating existing creosote treated wood stave wells, environmental issues for the land and surface water associated with the rehabilitation efforts are avoided.

**Independent Technical Review.** An independent technical review of the draft report was conducted by the Vicksburg District. Comments, responses, and resolution of comments were documented in Dr. Checks.

## **EXPECTED PROJECT PERFORMANCE**

**Project Costs.** Total project costs at October 2004 price levels are shown in the following table.

**Table 2 - Summary of Cost by Accounts** (Table 8-3 Main Report)

Feature Accounts	Costs \$	Contingency \$	Total Costs \$	Average Annual Benefit	Average Annual Cost
Limited Reevaluation Report	1,750,000	0	1,750,000		
Design Deficiency Correction – Relief Wells				2,605,000	812,600
01 Lands and Damages	96,900	5,500	102,400		
11 Levees and Floodwalls	6,690,000	669,000	7,359,000		
30 Planning, Engineering & Design	2,168,662	392,507	2,561,169		
31 Construction Management	719,000	179,750	898,750		
Total Design Deficiency Correction	9,674,562	1,246,757	10,921,319	BCR = 3.2	
Reconstruction – Gravity Drains				1,249,000	427,700
01 Lands and Damages	0	0	0		
11 Levees and Floodwalls	3,845,900	957,300	4,803,200		
30 Planning, Engineering & Design	519,200	137,852	657,053		
31 Construction Management	434,000	108,500	542,500		
Subtotal Gravity Drains	4,799,100	1,203,652	6,002,753		
Reconstruction – Closure Structures				1,274,000	342,500
01 Lands and Damages	0	0	0		
11 Levees and Floodwalls	2,608,600	543,500	3,152,100		
30 Planning, Engineering & Design	942,591	238,323	1,180,914		
31 Construction Management	310,000	77,500	387,500		
Subtotal Closure Structures	3,861,191	859,323	4,720,514		
Reconstruction – Pump Stations				1,120,600	448,000
01 Lands and Damages	0	0	0		
13 Pumping Plant	3,667,800	673,200	4,341,000		
30 Planning, Engineering & Design	660,247	166,417	826,664		
31 Construction Management	417,000	104,250	521,250		
Subtotal Pump Stations	4,745,047	943,867	5,688,914		
Total Reconstruction	13,405,338	3,006,843	16,412,181	3,643,600	1,218,200
				BCR = 3.0	
TOTAL Design Deficiency Correction and Reconstruction	23,079,800	4,253,600	27,333,400		
TOTAL PROJECT	24,829,800	4,253,600	29,083,400		

## Equivalent Annual Costs and Benefits.

**Table 3 - Recommended Plan – Expected Annual Costs and Net Benefits** (Table 6-1 Main Report)

<b>ESTIMATE OF EXPECTED ANNUAL NET BENEFITS</b>			
<b>ITEM</b>	<b>Total Levee System</b>	<b>Design Deficiency Correction (Relief Wells)</b>	<b>Reconstruction</b>
<b>Expected Annual Benefits</b>	<b>\$ 6,307,910</b>	<b>\$ 2,605,000</b>	<b>\$ 3,643,600</b>
<b>First Costs</b>	<b>27,333,400</b>	<b>10,921,300</b>	<b>16,412,000</b>
<b>Interest During Construction</b>	<b>3,390,200</b>	<b>1,354,600</b>	<b>2,035,600</b>
<b>Average Annual Investment</b>	<b>1,781,400</b>	<b>711,800</b>	<b>1,069,600</b>
<b>OMRR&amp;R<sup>1</sup></b>	<b>249,500</b>	<b>100,856</b>	<b>148,700</b>
<b>Total Average Annual Costs</b>	<b>2,030,900</b>	<b>812,600</b>	<b>1,218,200</b>
<b>B/C Ratio</b>	<b>3.11</b>	<b>3.21</b>	<b>3.0</b>
<b>Expected Annual Net Benefits</b>	<b>\$ 4,277,010</b>	<b>\$ 1,792,400</b>	<b>\$ 2,425,400</b>

<sup>1</sup>Reflects reconstruction/design deficiency correction project OMRR&R. An additional increase of \$9000 in average annual OMRR&R costs is estimated to account for 7 existing relief wells that are not included for replacement at this time.

## Cost Sharing.

**Table 4 - Cost Share Table** (Table 8-2 Main Report)

	Federal	Non-Federal	Total
PED (Limited Reevaluation Report and Plans & Specs for first Design Deficiency Correction Contract) Construction	\$1,312,500	\$ 437,500	<b>\$1,750,000</b>
5% Cash Requirement		\$1,366,670	<b>\$ 1,366,670</b>
LER		\$ 102,400	<b>\$ 102,400</b>
Additional Cash	\$17,591,710	\$8,272,620	<b>\$25,864,330</b>
<b>Total</b>	<b>\$18,904,210</b>	<b>\$10,179,190</b>	<b>\$29,083,400</b>

Cost-Sharing is 75% Federal/25% Non-Federal during PED LRR/Deficiency

Total Project Cost Sharing is 65% Federal/35% Non-Federal

**Project Implementation.** The non-Federal sponsor for project implementation, both design deficiency correction and reconstruction, is the Wood River Drainage and Levee District. The non-Federal sponsor's responsibilities will be defined in a Project Cooperation Agreement. There are no institutional arrangements with the state or other partners in this project.

**Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R).**

Annual OMRR&R costs are estimated to be \$249,500 for the reconstruction/design deficiency correction features and an additional \$9000 annually to account for seven newer relief wells that will not be replaced at this time.

**Key social and environmental issues.** An environmental assessment was completed and based on the analysis of the impacts that would result from both the design deficiency correction and reconstruction project, a finding of no significant impact is recommended.

- The project is intended to provide protection against a 52 foot Mississippi River stage on the St. Louis Gage, which has a current expected frequency of greater than 500 years.
- As a result of the nature of the industries who have dominated the riverfront area, a number of sites are in the State Site Remediation Program. In addition, there are several Resource Conservation and Recovery Act (RCRA) sites and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (commonly known as Superfund sites) in the area. These combined sites occupy thousands of acres of the floodplain with Shell Oil being the largest with 2220 acres. The loss of the Wood River Levee system would not only have the implication of creating an environmental contamination scenario not experienced on any inland waterway system to date. Not only would the land-side of the levee experience significant contamination from oil, oil byproducts and chemicals used in the refining process, but the Mississippi River system itself would be impacted. At a conservative estimate of \$125,000 per acre of clean up costs a loss of this levee would result in environmental damages exceeding \$2,000,000,000 (two billion dollars) not including the relocation costs of residents and future loss of agriculturally productive land.
- A two-mile portion of the Levee provides containment for the navigation pool at the Mel Price Lock and Dam. Loss of this pool would stop the movement of goods on the upper Mississippi River system between St. Louis and St. Paul and Chicago. The Conoco-Phillips facility produces defense grade fuels including some 1,500,000 gallons a day of jet fuel. The Winchester Division of the Olin Corporation supports munitions production for the Defense Department and law enforcement agencies across the nation, while the Brass Division provides copper and copper alloy strip used to support a variety of industrial purposes as well as the U.S. Mint. Interruption to these fuel and munitions production activities would not only adversely impact the area in traditional economic terms but also have implications to defense and national security needs. Additionally, any loss of refinery capability would impact gasoline availability and prices throughout the mid-west and western states.
- A risk based economic analysis was completed for the study area. Results indicated a total structural value of residential, commercial and industrial buildings inventoried in the study area as being slightly over \$1.5 billion.

**Stakeholder perspectives and differences.** During the draft report comment period a public meeting was conducted to provide information and clarification of questions related to the project. Copies of the draft report were provided to state and local officials, area libraries, local industry, and regional economic groups. Additionally, the draft report was available on the District's website. Coordination has also occurred with the Levee and Drainage District, local units of government, the State of Illinois, business groups, and major industrial customers of the area. Additionally, the study has been discussed monthly at the Metro East Regional Stormwater Committee Meetings, which are a public/private coalition of interested parties or the metropolitan area that meet monthly to address local issues and concerns regarding flooding and stormwater management.